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COMPARATIVE EVALUATION OF SPECIFIC METHODS  
FOR COMBATING HOG CHOLERA

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Measures for combating hog cholera comprise passive immunization [inoculation with serum], simultaneous or active immunization [inoculation with both virus and serum], and inoculation with crystal-violet vaccine.

The first two methods are used at farms affected by the disease, while the third is used at farms or sections of farms threatened by the disease. Each of these methods is used in combination with general sanitary measures in procedures the purpose of which is either to stop an outbreak (the first two methods) or to prevent it (the third method).

Sick hogs, hogs which are suspected of being sick, and chronically sick hogs are immediately isolated. Chronically and hopelessly sick animals are slaughtered. The temperature of all remaining hogs is measured at farms unsafe with regard to hog cholera. Animals which have been found sick are inoculated with therapeutic (double) doses of anticholera serum and isolated, while all other animals are inoculated with prophylactic (single) doses of this serum. If a herd is badly infected, the hogs of this herd are also inoculated with therapeutic doses of the serum in order to save infected animals that have the disease in its incubation stage. Hogs at farms threatened by infection are inoculated with prophylactic doses of anticholera vaccine or with crystal-violet vaccine. On completion of the inoculations, thorough cleaning and disinfection of the buildings and surrounding grounds are carried out.

After carrying out the measures outlined above, one might expect that further cases of the disease would be prevented. However, feverish animals are observed on subsequent days among those hogs that have received prophylactic or therapeutic doses of anticholera serum. This refers to animals

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that had normal temperatures and appetites before the inoculations were given. Such animals are inoculated with therapeutic doses of serum and isolated. Some animals of this group recover, while others begin to exhibit symptoms of hog cholera.

Hogs of this group already had the disease in the incubation stage at the time of the inoculations. Single or double doses of anticholera serum do not counteract the virus under the circumstances, or prevent the disease from developing into the open form.

In connection with the isolation of sick animals, inoculations with anticholera serum are carried out at unsafe pigsties every 10 days until the disease no longer occurs. Experience shows that no less than three and no more than four such inoculations must be carried out. After every isolation of sick animals, a thorough disinfection of the building is carried out. As soon as isolation of sick animals has been terminated, the buildings in which the pigs are kept, as well as the surrounding grounds, are thoroughly disinfected.

This does not stop the occurrence of further cases of the disease, however. At the expiration of 20 to 30 days and occasionally even later, outbreaks of hog cholera take place, so that inoculations with anticholera vaccine must be repeated and all measures described above carried out again.

As a result of these outbreaks, there is reinfection of the hogs with natural virus. This, in combination with the multiple injections of anticholera serum which had been made, leads to active immunity in the animals, so that further incidences of the disease do not occur.

If a timely diagnosis of cholera has been made, i. e., the diagnosis has been made when there are only a few sick pigs in the herd, cholera can be eliminated in 30 days, provided that the sick pigs have been isolated from the rest of the herd and the remaining animals have been inoculated with serum thrice at 10-day intervals.

Compared with inoculations producing passive immunity, simultaneous inoculations have the advantage that the hogs subjected to simultaneous inoculations acquire a lasting active immunity, which is equivalent to elimination of the epizooty at the farm.

Simultaneous inoculations have the following drawbacks:

1. A period of 2.5-3 months or longer is required in order to treat all hogs. As a result of the inoculations, dispersion of the virus takes place, both through the actual giving of inoculations and through the agency of the inoculated hogs. Consequently, the buildings in which the pigs are kept become strongly infected with the virus.
2. Simultaneous inoculations do not always impart immunity to sucklings.
3. Large quantities of anticholera serum are used in simultaneous inoculations.

The long time necessary for treating hogs by the method of simultaneous inoculations is connected with the fact that inoculations must be carried out at breeding farms where there are sows in various stages of pregnancy, sows which are feeding young pigs of various ages, and young, growing pigs. Sucklings younger than 20 days should not be inoculated because simultaneous inoculations at this age may be ineffective. Gravid sows are usually not inoculated within one month before giving birth because the inoculations may

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produce miscarriages. Sows which are feeding young also are not inoculated because the reaction to the inoculation may stop lactation and thus lead to the death of sucklings.

In carrying out simultaneous inoculations, we found that the time necessary for treating a herd may be cut in half. Observations made by a number of USSR authors, as well as our own experience, show that introduction of double doses of anticholera serum and of single doses of virus brings about only a weak reaction in the hogs being inoculated. This reaction lasts for 1-2 days. Often, a temperature reaction is completely absent, a fact that has no deleterious effects on the activity and duration of the immunity.

In 1949, the animals at a farm unsafe with regard to hog cholera were treated by the method of simultaneous inoculations. A group of 350 young animals intended for fattening was inoculated with double doses of anticholera serum and single doses of hog cholera virus. These animals had been safe with regard to hog cholera, but unsafe as far as bronchial pneumonia was concerned. Temperature and degree of fattening were normal throughout the group. In 40% of the young pigs thus inoculated, the reaction was expressed in a temperature increase of 0.4-0.8° with no noticeable changes in the general state of health. The rest of the young pigs inoculated in this manner did not exhibit any noticeable organic or temperature reactions. Three piglets, 4-10 months old, were removed from the latter group 25 days after the inoculations. In order to test the immunity of these three animals, injections of 2-ml doses of hog cholera virus were given. The animals were then observed for 30 days. Their temperature was measured twice a day. All three piglets remained alive and not one of them exhibited either an increase of temperature or changes in the general state of health.

Having ascertained that double doses of anticholera serum have a beneficial effect on the course of the post-inoculation reaction, as early as 4 days after birth we carried out extended experiments on the simultaneous inoculation of sows feeding sucklings (when feeding sows had sucklings older than 20 days, both sows and sucklings were inoculated at the same time), of all available gravid sows (with the exception of any that were within 15 days of giving birth), and of animals suffering from bronchial pneumonia whose cough was not very pronounced and who had a normal degree of fattening and temperature. All these hogs were inoculated with double doses of anticholera serum and single doses of hog cholera virus.

The reaction to the simultaneous inoculations took a light course in the majority of the animals thus inoculated, and there were no ill effects on the animals' health. No abortions took place in the case of gravid sows. There was no reduction of lactation in sows feeding suckling pigs.

All other hogs, except those belonging to the classes enumerated above, were treated by inoculating with single (prophylactic) doses of serum, together with single doses of virus. Hogs which were temporarily excluded from the application of simultaneous inoculations received serum inoculations only. Subsequently these hogs were also given simultaneous inoculations.

By adhering to the scheme outlined above, one may complete treatment of a whole herd with simultaneous inoculations in 30-45 days.

Sucklings born of sows that were given simultaneous inoculations undergo the reaction in the embryonic state. They are immune to hog cholera for that reason and, consequently, do not have to be inoculated. Furthermore, they get immunizing antibodies with the mother sow's milk.

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When simultaneous inoculations have been carried out according to the procedure described above, all necessary measures are taken to destroy the hog cholera virus which may be present at the farm.

Beginning with 1931, we treated up to 48,000 hogs by the method of simultaneous inoculations. After the inoculations, recurrence of hog cholera was not observed in a single case. The maximum loss from simultaneous inoculations amounted to 0.5-1.5%, and frequently there were no losses at all.

To reduce losses, brigades strongly affected by hog cholera, after isolating sick animals and animals suspected of being sick, should carry out inoculations with therapeutic doses of anticholera serum and 10 days later give simultaneous inoculations.

In 1936, after removal of the hog cholera quarantine at a farm (i. e., 3 months after reactions to simultaneous inoculations were no longer exhibited), we instituted the biological check described below to find out whether the farm in question was safe in regard to hog cholera. Twenty pigs, 4-10 months old and destined for fattening, were transferred to this farm from another farm which had never had hog cholera. These pigs were distributed among the pigsties of the farm, so that five of them were placed in every pigsty. They were fed and taken to pasture together with the general herd of the sovkhos. Observation during 50 days showed that none of the 20 pigs, all of which remained alive, exhibited either an increase of temperature or any signs of ill health. This experiment demonstrated that the virus of hog cholera had been eliminated from the farm herd.

In 1937, a biological test for the presence of immunity was conducted on three hogs intended for fattening. These hogs were 12 months old and had been subjected to simultaneous inoculation 11 months earlier. They were placed in the isolation sty (isolyator) next to hogs having cholera and were injected with 2 ml of hog cholera virus. They were then observed for 30 days and their temperatures measured daily. None of the three hogs died, showed an increase of temperature, or exhibited any changes in the general state of their health. This experiment proved that suckling pigs which undergo simultaneous inoculations preserve active immunity from hog cholera for 11 months.

In giving simultaneous inoculations to a herd composed of various groups of production animals, we use, on the average, 70-100 ml of anticholera serum per head. Elimination of an epizooty by the method of simultaneous inoculations requires three to five times less serum than its elimination by the method of passive immunization.

According to instructions, inoculation with crystal-violet vaccine may be carried out at farms which are not directly threatened by hog cholera infection.

In 1947, 507 hogs kept in safe pigsties of a farm which was unsafe with regard to hog cholera were inoculated once with crystal-violet vaccine. Ten days after the inoculation, 25 of the inoculated hogs contracted hog cholera. Elimination of the epizooty at these pigsties, among the pigs which were inoculated with crystal-violet vaccine, had to be carried out by passive immunization.

Two hundred young, growing pigs intended for fattening were transferred to the same farm. These pigs had been inoculated twice with crystal-violet vaccine. The transfer was carried out on the 16th day after completion of the second inoculation. Twelve days after the transfer, 33 of the transferred animals contracted hog cholera. The situation was taken care of by passive immunization.

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In 1949, at a farm under acute threat of infection with hog cholera, 3,003 hogs were inoculated twice with crystal-violet vaccine. Vaccine produced by Biologicals Plant No 12 and dated 2 April 1949 (Series No 210) was used. Seventeen days after the second inoculation, the inoculated hogs developed hog cholera. Originally, 39 animals became sick. A week later, the number of sick animals reached 251. Simultaneous inoculations had to be used to stop the epizooty. At the same farm, it was observed that hogs having a mild form of bronchial pneumonia developed a more acute form of this disease after being inoculated with crystal-violet anticholera vaccine. Thus, out of 311 hogs intended for fattening which had bronchial pneumonia in a hardly noticeable form, 150 animals developed increased temperatures or high temperatures ( $40.3-41.5^{\circ}\text{C}$ ), sharply pronounced coughing, an abdominal type of respiration, and loss of appetite after the second inoculation with crystal-violet anticholera vaccine. In that connection, the losses from bronchial pneumonia increased.

#### Conclusions

1. Among specific methods for combating hog cholera, the method of simultaneous inoculations remains one of the most effective. By using this method, epizooties can be checked in a comparatively short time with insignificant losses. The quantity of anticholera serum required is three to five times less than for inoculations establishing passive immunity.
2. Application of double doses of anticholera serum in simultaneous inoculations brings about a weak reaction without diminution of the activity or duration of the immunity established.
3. Application of double doses of serum permits extension of the method of simultaneous inoculations to groups of hogs which could not be thus treated before. It also permits complete treatment of a herd within 30-45 days.
4. Experimental results show that active immunity is preserved for a long time when sucklings pigs have been immunized by simultaneous inoculations.
5. Simultaneous inoculations in combination with cleaning and disinfection completely eliminate the virus of hog cholera from a farm so that the farm does not become a lasting focus of infection.
6. Application of the method of passive immunization at a strongly infected farm prolongs the epizooty and results in increased losses. Furthermore, a large quantity of serum is used up in the multiple inoculations which are necessary.
7. Under application of the method of passive immunization, the epizooty is prolonged, because serum inoculations do not eliminate the virus from the organism of hogs which have the disease in the incubation stage. In a relatively healthy herd, serum inoculations do not eliminate the virus from the organism of hogs which have recovered from the disease, they continue to carry the virus, with the result that healthy hogs are infected at a later date and outbreaks of the disease are produced.
8. In individual cases, hog cholera can be eliminated within a short time by the method of passive immunization. To bring this about, all hogs which are sick or suspected of being sick must be isolated from the farm herd; three inoculations of serum with intervals of 3 days between them must be carried out; all measures necessary for eliminating the virus from the buildings and grounds must be taken.

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9. When there was an actual threat of infection, two inoculations with crystal-violet vaccine did not, in our experience, protect hogs from infection. The reason was apparently the long time necessary for establishing immunity after the inoculations. Unless the inoculated hogs are isolated for an undetermined long period (not less than one month), the benefit derived from crystal-violet vaccine is doubtful.

10. Crystal-violet vaccine has the following drawbacks:

- a. Mild cases of bronchial pneumonia are aggravated by it.
- b. Anticholera serum must be used for inoculating animals which cannot be inoculated with crystal-violet vaccine.

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